Claims:

1. A method of transferring energy from a power source into an output node, said method comprising:

separately charging each of a plurality of energy storage elements from the power source;

after the plurality of energy storage elements are charged, discharging a selected one of said plurality of energy storage elements through an inductive element into the output node; and

as the selected energy storage element is being discharged through the inductive element, when its voltage reaches a preselected value, discharging another one of said plurality of energy storage elements through the inductive element into the output node.

2. The method of claim 1 wherein during the charging step each of the plurality of the energy storage elements is charged to a corresponding voltage, and wherein the method further comprises selecting as the selected energy storage element the one of said plurality of energy storage elements with the largest voltage.

3. The method of claim 1 wherein the output node is at an output voltage and wherein the voltage of the selected energy storage element is at least two times the output voltage.

4. The method of claim 1 wherein a complete cycle of operation includes the above described charging steps followed by the above-described discharging steps, and wherein said method further comprises causing a complete cycle of operation to occur multiple times per second.

5. The method of claim 1 further comprising after the plurality of energy storage elements are charged and

before discharging a selected one of said plurality of energy storage elements, inverting the polarity of charge stored in at least some of said plurality of energy storage elements.

6. A method of transferring energy from a power source into an output node, said method comprising:

from the power source, charging a first energy storage element to a first voltage;

from the power source, charging a second energy storage element to a second voltage;

after the first and second energy storage elements are charged, discharging a first selected one of said first and second energy storage elements through an inductive element into the output node and

as the first selected energy storage element is being discharged through the inductive element, when its reaches a preselected value, discharging a second selected one of said first and second energy storage elements through the inductive element into the output node.

7. The method of claim 6 wherein the first voltage is larger than the second voltage and wherein the first selected one of said first and second energy storage elements is the first energy storage element and the second selected one of said first and second energy storage elements is the second energy storage element.

8. The method of claim 6 wherein the output node is at an output voltage and wherein at least one of said first and second voltages is greater than two times the output voltage.

9. The method of claim 6 wherein a complete cycle

of operation includes the steps of first charging and then discharging the first and second energy storage and wherein said method further comprises causing a complete cycle of operation to occur multiple times per second.

10. The method of claim 6 wherein the power source is a multiphase line including a first line and a second line and wherein the step of charging the first energy storage element is performed from the first line and wherein the step of charging the second energy storage element is performed from the second line.

11. A sequential discharge circuit for transferring energy from a power source into an output node, said circuit comprising:

a plurality of energy storage elements connected to receive energy from the power source;

a shared inductive element connected between the plurality of energy storage elements and the output node;

a plurality of unidirectional switches, each of which when turned on discharges a corresponding different one of said plurality of storage elements through said shared inductive element into the output node, each of said unidirectional switches having a control terminal through which it is turned on; and

a control unit connected to the control terminals of the plurality of unidirectional switches and controlling the operation of the plurality of unidirectional switches.

12. The sequential discharge circuit of claim 11 wherein said plurality of energy storage elements includes a first energy storage element and a second energy storage element, wherein the plurality of unidirectional switches includes a first unidirectional

switch connected to the first energy storage element and a second unidirectional switch connected to the second energy storage element, and wherein the control unit is programmed to perform the steps of:

charging the first energy storage element from the power source;

charging a second energy storage element from the power source;

after the first and second energy storage elements are charged, discharging a selected one of the first and second the energy storage elements through the shared inductive element into the output node; and

as the selected energy storage element is being discharged through the inductive element, when its voltage reaches a preselected value, discharging the other one of said first and second energy storage elements through the inductive element into the output node.

13. The sequential discharge circuit of claim 11 further comprising monitoring the voltage across the selected energy storage element to detect when the voltage of the selected energy storage element reaches said preselected value.

14. The sequential discharge circuit of claim 11 wherein the inductive element comprises an inductor.

15. A sequential discharge circuit for transferring energy from a power source into an output node, said circuit comprising:

a transformer with a primary and a secondary;

a plurality of energy storage elements connected to receive energy from the power source;

a plurality of unidirectional switches, each of which when turned on discharges a corresponding different

one of said plurality of storage elements through the primary of said transformer, each of said unidirectional switches having a control terminal through which it is turned on; and

a control unit connected to the control terminals of the plurality of unidirectional switches and controlling the operation of the plurality of unidirectional switches.

16. The sequential discharge circuit of claim 15 further comprising a shared inductive element connected between the secondary and the output node.

17. The sequential discharge circuit of claim 15 further comprising a shared inductive element connected between the primary and said plurality of unidirectional switches.

18. A power conversion system for extracting energy from a power source and delivering it to an output node, said system comprising:

a transformer having a primary winding and a secondary winding;

a unidirectional switching device coupled between the power source and the primary winding of the transformer;

a plurality of capacitors connected in series;

a charging circuit connected to said plurality of capacitors, said charging circuit charging the plurality of capacitors from the secondary winding of the transformer to a predetermined voltage;

a polarity inverting circuit inverting the polarity of the charge stored in selected capacitors of said plurality of capacitors, said polarity inverting circuit including a plurality of inductor circuits, each of which can be switchably coupled to a corresponding

different one of the selected capacitors to form a resonant circuit which aids in inverting the polarity of a stored charge in that capacitor; and

a discharging circuit extracting power from the plurality of capacitors at a transformed voltage.

19. The power conversion system of claim 18 wherein said transformer is a step-up transformer.

20. The power conversion system of claim 18 wherein said transformer is an isolation transformer.

21. A power conversion system for extracting energy from a power source and delivering it at a transformed voltage to an output node, said system comprising:

a transformer having a primary winding and a secondary winding, said secondary coupled to the output node;

a plurality of capacitors connected in series;

a charging circuit connected to said plurality of capacitors, said charging circuit charging the plurality of capacitors from the power source to a predetermined voltage;

a polarity inverting circuit inverting the polarity of the charge stored in selected capacitors of said plurality of capacitors, said polarity inverting circuit including a plurality of inductor circuits, each of which can be switchably coupled to a corresponding different one of the selected capacitors to form a resonant circuit which aids in inverting the polarity of a stored charge in that capacitor; and

a discharging circuit extracting power from the plurality of capacitors and delivering it to the primary of the transformer.

22. The power conversion system of claim 21 further comprising a unidirectional device coupling the secondary winding to the output node.

23. The power conversion system of claim 21 wherein said transformer is a step-down transformer.

24. The power conversion system of claim 21 wherein said transformer is an isolation transformer.

Sub B2

25. A system for controlling VAR of a multiphase grid, said system comprising:

a plurality of charge storage elements;

a plurality of charge transfer circuits each connected to a corresponding phase of the multiphase grid and to a corresponding one of the plurality of charge storage elements; and

a charge redistribution circuit connected to the plurality of charge storage elements, wherein during operation the charge redistribution circuit redistributes charge among the plurality of charge storage devices.

26. The system of claim 25 further comprising a controller which operates the plurality of charge transfer circuits and the charge redistribution circuit, wherein during operation the controller causes the plurality of charge transfer circuits to transfer charge to the plurality of charge storage elements, causes the charge redistribution circuit to redistribute the charge that was transferred to the plurality charge storage elements, and causes the charge transfer circuit to transfer the redistributed charge to the grid.

27. A power flow control system for connecting to a multiphase grid, said system comprising:

a plurality of charge storage elements;

a plurality of charge transfer circuits each connected to a corresponding phase of the multiphase grid and to a corresponding one of the plurality of charge storage elements;

a charge redistribution circuit connected to the plurality of charge storage elements, wherein during operation the charge redistribution circuit redistributes charge among the plurality of charge storage devices; and

a controller operates the plurality of charge transfer circuits and the charge redistribution circuit, wherein said controller controls the power flow into the system by establishing non-zero initial conditions on the plurality of charge storage elements prior to a charge transfer cycle during which charge is exchanged between the grid and the charge storage elements.

28. A derectification system for generating from a power source a multiphase AC output onto a grid, said system comprising:

a plurality of charge storage elements;

a first charge transfer circuit which charges the plurality of charge storage elements from the power source;

a second charge transfer circuit which transfers charge between the plurality of storage elements and the multiphase grid; and

a controller which operates the first and second charge transfer circuits, wherein the controller causes the second transfer circuit to discharge the plurality of charge storage elements onto the grid in order of increasing voltage, starting with the charge storage element with the lowest voltage and ending with the charge storage element with the highest voltage.

29. In a system including a plurality of charge storage elements that are coupled to a power source through a circuit which includes an inductor, a method of generating a multiphase AC output onto a grid, said method comprising the steps of:

sequentially transferring charge between the power source and each of the plurality of charge storage elements so that each of said charge storage elements is characterized by a voltage corresponding to the charge stored therein;

transferring charge between each of said plurality of charge storage elements and a corresponding one of said phases on said grid, wherein the step of sequentially transferring charge is performed in order of increasing voltage on the charge storage elements.

30. In a system which includes a plurality of charge storage elements, a method of controlling power flow between a multiphase grid and said system, said method comprising the steps of:

establishing non-zero initial conditions on the plurality of charge storage elements; and

after establishing non-zero initial conditions on the plurality of charge storage elements, transferring charge between the multiphase grid and the plurality of charge storage elements.